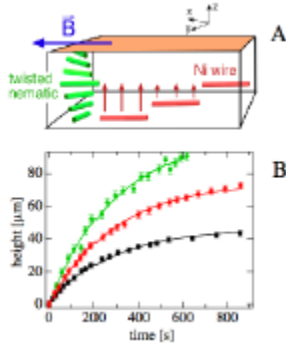


## Levitating Magnetic Nanowires in Twisted Liquid Crystals

Fluids composed of complex molecules can display variety of surprising and unusual properties that are never seen in ordinary fluids like water. Liquid crystals are an important class of complex fluids that have wide-ranging applications such as in display technology as well as considerable scientific interest. In the so-called nematic phase of a liquid crystal composed of rod-like molecules, the long axes of the molecules prefer to orient parallel to one another, unlike an ordinary liquid, where the molecular orientation is completely random. Interactions between the liquid crystal molecules and solid surfaces can be manipulated to control the molecular alignment, for example to orient all the liquid crystal molecules in a container in a particular direction. Conversely, if a small particle is suspended in a liquid crystal, these liquid-solid interactions can be exploited to manipulate the particle. In recent work, we have shown that it is possible to employ these effects to orient micrometer sized, needle-shaped metal particles in a liquid crystal and even to levitate them against the force of gravity.



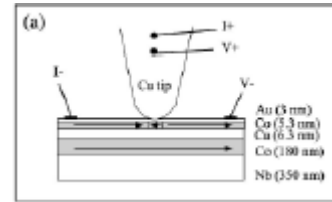
*Fig. 1 Levitation of a nickel wire within a twisted nematic liquid crystal (LC). **A:** The LC orientation (green), twists uniformly as a function of height to match the directions of planar anchoring at the upper and lower surfaces. When a magnetic field aligns a nanowire parallel to LC at some height in the cell (e.g., at the center of the cell in the figure), the elastic energy becomes a function of the wire's height, leading to a levitating force on a wire resting on the bottom substrate. **B:** Measurements demonstrate the height of a wire initially resting at the bottom rises as a*

*function of time in response to this force.*

*C. Lapointe, A. Hultgren, D. M. Silevitch, E. J. Felton, D. H. Reich, and R. L. Leheny, "Elastic Torque and the Levitation of Metal Wires by a Nematic Liquid Crystal," *Science* **303**, 652 (2004).*

## Switching by Point Contact Spin Injection in a Continuous Trilayer

Spin-transfer torque (STT) offers the prospects of switching magnetization via a spin-polarized current without an external magnetic field. This STT effect has been observed in pillars of trilayers made by nanolithography. We report the observation of current-driven switching using a point contact in a continuous Co/Cu/Co trilayer involving no lithography as shown in Fig.



*Fig.1. (a) A point-contact between a metal tip and a Co/Cu/Co trilayer with a Nb under layer and a Au cap layer.*

*T. Y. Chen, Y. Ji, and C. L. Chien, "Reversible Switching in Continuous Films by Point Contact Injection," Appl. Phys. Lett., **84**, 380 (2004).*

## Physics Fair (April 24, 2004)



A Physics Fair was held at the Bloomberg Center of Physics and Astronomy at the Johns Hopkins University on April 24, 2004 during the Hopkins Spring Fair. The Physics Fair was jointly sponsored by the JHU MRSEC and the QuarkNet. Fliers and invitations were sent to the secondary schools in the greater Baltimore City region. We have attracted over 400 participants in attending various activities, including

- 100 hands-on demonstration apparatuses
- participation of over 50 graduate and undergraduate students.
- 32 outside students entered the written physics challenge contest.
- nine teams entered the physics bowl contest.
- many participants used the in-house telescope.
- 150 participants attended the “physics show” given by Professor Cal Walker.

Given the very favorable response from the outside visitors, we plan to host another Physics Fairs in April 2005.



MRSEC student explains  
Marshmallows to Crystal models

Low Temperature Wonders Prof. Walker Demonstrates